



ABSTRACT OF THE DISCLOSURE

A substrate is set at a predetermined temperature in a plasma treatment chamber, then the inside of the plasma treatment chamber is regulated at a reduced pressure containing at least a silicon hydride gas and a hydrogen gas, a high-frequency electric field is applied to form a silicon film of nanometer scale thickness composed of fine silicon crystals and amorphous silicon on the substrate. Thereafter, application of the high-frequency electric field is terminated, then the inside of the plasma treatment chamber is replaced by an oxidizing or nitriding gas, and a high-frequency electric field is applied again for plasma oxidizing treatment or plasma nitriding treatment of the silicon film formed on the substrate.

Thereby, a silicon nanocrystalline structure can be formed on a silicon substrate by using a process of producing silicon integrated circuits with achieving high luminous efficiency, and terminating reliably with oxygen or nitrogen on the surface thereof. According to the method of the present invention, the particle diameter of the oxygen- or nitrogen-terminated silicon nanocrystals can be regulated in an accuracy of 1 to 2 nm, the density thereof per unit area can be increased, and the silicon nanocrystalline structure can be produced easily and inexpensively.